MM. Fayet and Schaumasse find the elements of the orbit of this object to be almost identical with those of Tuttle's comet.

Comet 1912*a* (Gale).—The following set of elements for the orbit of comet 1912*a*, from which he derived the corrected ephemeris we gave last week, is published by Dr. Ebell in No. 4604 of the *Astronomische Nachrichten*; it is based on observations made on September 8, 17, and 26:—

$$
\begin{aligned}
T &= 1912\text{ October }4{\cdot}95917\text{ M.T. Berlin.}\\
\left.\begin{aligned}
\omega &= 25^\circ\ 33'\ 37{\cdot}9''\\
\text{☊} &= 297\ \ \ 2\ \ 53{\cdot}3\\
i &= 79\ \ 51\ \ 10{\cdot}2
\end{aligned}\right\}&\ 1912{\cdot}0\\
\log q &= 9{\cdot}854958
\end{aligned}
$$

A further extract from the ephemeris is given below:—

Ephemeris 12h. M.T. Berlin.

1912	α (true) h. m.	δ (true) ° ′	1912	α (true) h. m.	δ (true) ° ′
Oct. 25	15 57·0	+19 20·5	Oct. 29	16 0·5	+22 26·5
26	15 57·9	+20 8·1	30	16 1·3	+23 11·1
27	15 58·8	+20 55·0	31	16 2·1	+23 55·2
28	15 59·6	+21 41·1	Nov. 1	16 3·0	+24 38·7

During the period covered by this ephemeris the calculated decrease in magnitude is 0·5.

Measuring the Angular Diameters of Stars.—In No. 2, vol. xxxvi., of *The Astrophysical Journal*, Dr. Pokrowsky suggests a method whereby it should become possible to measure the angular diameters of stellar objects, a result which, if obtained directly, would greatly widen our knowledge of stellar physics. The method is too technical in detail to be given here, but it depends upon the consideration that if two rays emanate from different points on the surface of a distant light-source, such as a star, there will be a difference of phase depending upon the distance between the two points. These two systems of rays after polarisation form two images of different intensities in the focus of a telescope, and Dr. Pokrowsky shows that by measuring the difference of intensity the angular diameter of the star may be derived; thus the problem is reduced to one of stellar photometry, and it is calculated that for bright stars, such as Arcturus, Canopus, Capella (average magnitude, say, =0·0), angular diameters of 0·0031″ might be discovered. As the method would be very sensitive, atmospheric conditions would greatly interfere, and the apparatus could only produce positive results at a mountain observatory.

The Perseids of August 12, 1912.—Some interesting data concerning the meteor shower of August last are given by Prof. Zammarchi, in No. 10, vol. i. (2nd series), of the *Memorie della Società degli Spettroscopisti Italiani*. The observations were made at the meteorological observatory attached to the seminary at Brescia, and in a total of 13·6 hours, spread over the nights of August 10, 11, 13, and 14, six observers recorded 170 meteors. The greatest horary rate occurred on August 11, when 93 meteors were seen in four hours; on August 12 the sky was covered and observations impossible. For each meteor the time, the magnitude, and the appearance are given, and in many cases the position of the beginning and end of the path.

The Physical Cause of the *z*-Term in Latitude Variation.—A possible cause producing the *z*-term in latitude variation is suggested by Mr. S. Shinjo in a paper of which we have received a reprint from the *Tôkyô Sûgaku-Buturigakkwai Kizi* (second series, vol. vi., No. 16), published by the Tokio Mathematico-Physical Society. Putting on one side, as unlikely, the possibility of its being due to systematic error in the observations and the suggestion that it is due to real changes in the earth, Mr. Shinjo reverts to the probability that the *z*-term is introduced by the action of anomalous refraction. But no such inclination of the atmospheric strata as is necessary to produce the anomalous refraction has been observed over any large area. Mr. Shinjo, however, inquires into the purely local conditions appertaining to and immediately surrounding the observing station, and suggests that in these very localised areas the atmospheric gradient is frequently sufficiently sharp; for example, the difference in temperature between the sun side and the shade side of the observing hut might produce a pressure-gradient sufficient to produce the *z*-term. He concludes that the greater part of the term is probably produced by this cause, about one-fourth as a consequence of the daily variation of the pole, as remarked by Sitter, and a small part may possibly be due to real change in the earth.

THE BECQUEREL MEMORIAL LECTURE OF THE CHEMICAL SOCIETY.

An extra meeting of the Chemical Society was held on Thursday, October 17, when Sir Oliver Lodge, F.R.S., delivered a memorial lecture in honour of Antoine Henri Becquerel, late honorary and foreign member of the Chemical Society. Prof. Percy F. Frankland, F.R.S., president of the society, occupied the chair.

Sir Oliver Lodge referred to the changes that of recent years have come over physical science. Not many years back its progress appeared to be placid, along well-worn channels, and based upon the substantial knowledge of the past. To-day it is characterised by intense speculative activity on the one hand, and, on the other, by exceptional scepticism.

Discoveries are of two chief kinds: the discovery of law and the discovery of fact. The discovery of law often leads to the discovery of new facts, and the discovery of new facts to either the formulation of new laws or new modes of statement, or to the resuscitation of discarded ones. As examples of the discovery of law may be instanced Newton's gravitational theory of astronomy, Maxwell's electro-magnetic theory of light, the atomic theory of chemistry, and the conservation of energy. As examples of the discovery of fact may be quoted the prehistoric discovery of flame, the discovery of static electrification, of the electric current, of magneto-electricity, of the electron, and of spontaneous radio-activity.

Of the scientific discoveries made during the past fifty years, that of the Röntgen X-rays perhaps created the most widespread interest; but even more striking and revolutionary was Becquerel's discovery of the spontaneous radio-activity of matter, for the spontaneous splitting up of atoms and the consequent expulsion of constituent fragments was not provided for on any theory.

A discovery of essential novelty cannot be made by following up a train of prediction. It is often made during the process of following a clue, but the clue does not logically lead to it. A really new fact comes as a side issue—something unexpected and that might have been overlooked. The discovery which has been pointed to by theory is of great value, but it is usually the outcome of a long and fruitful period; whereas the discovery which comes as a surprise generally marks a fresh epoch, and opens a new chapter in science.

So with the discovery of spontaneous radio-activity. Becquerel was looking for the possible emission of Röntgen rays by a fluorescent substance. It was a reasonable thing to look for, and had it been found

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would have made an interesting extension of our knowledge; but, when critically examined, the kind of radiation turned out to be for the most part not Röntgen rays, but corpuscular, and to have nothing to do with fluorescence.

Becquerel set himself carefully to examine the kind of penetrating radiation which fluorescent substances exposed to light might be found to emit. Though not finding that for which he sought, he made a discovery of far greater importance.

After giving an account of the recent discoveries in radio-activity, the lecturer dwelt on the present trend of scientific thought; of the tendency to return to discarded hypotheses such as spontaneous generation and the corpuscular theory of light. Our attitude amongst so many conflicting hypotheses should be to admit that any law applicable to concrete objects and established by induction on a basis of experience must be of the nature of a postulate; that we should hold some of the postulates as so well-established that arguments necessitating their overhauling should, *ipso facto,* to that extent be discredited, and should not receive our encouragement unless supported by new facts. Our endeavours should be to harmonise new facts with the firmly established laws of physics until compelled to look for some higher generalisation.

Reference was then made to some of the well-established laws, and to the attempts to construct living matter from artificially combined materials. Life demands energy for its manifestations, and radio-activity may be suggested as a possible source of such energy. It is known that atoms give off energy as they disintegrate; that organic compounds likewise disintegrate and evolve energy, finally becoming inorganic. A decaying heap of refuse represents a close chemical analogy to the physical activity of uranium—one is an affair of atoms, the other of molecules. This stock of energy running to waste seems eligible for guidance. Life has to control this spontaneous disintegration of protoplasmic cells, to regulate the activity of the ganglia in the brain, for instance, or to suspend the disintegration of organic material until some appointed time, and then to direct it along some determined channel. We have yet to discover how life achieves this control. Those who say that life cannot guide material processes unless it is itself a form of energy, and those holding that life cannot act at all unless energy is at its disposal, forget the spontaneous activity of complex organised molecules and the atomic disintegration manifested by radio-activity.

There is a great difference between matter potentially living and actually alive. In the physical universe our power is limited to the movement of matter; after that, all that happens is due to the properties of matter and its ethereal environment. If potentially living matter is ever artificially made by placing things in juxtaposition and bringing physical resources to bear upon the assemblage, then it may become alive. If this last step be taken, it will be because something beyond matter, something outside the region of physics and chemistry, has stepped in and utilised the material aggregate provided. Only in this sense did the lecturer consider that the artificial incarnation of life would be possible. Some day life may appear under observation, but it will not be manufactured, any more than radium or radio-activity has been manufactured.

Sir Oliver Lodge spoke of the tendency of present-day science to materialise the invisible, quoting, among other examples of this, the fact that plague, which in olden times was attributed to such mysterious causes as a conjunction of the planets, the iniquities of the Jews, &c., is now known to be due to a minute vegetable parasite living on the fleas of rats.

The scientific life and work of Antoine Henri Becquerel were then dealt with, and an account given of his chief discoveries. A vote of thanks to Sir Oliver Lodge, proposed by Sir William Crookes, O.M., F.R.S., seconded by Prof. Henry E. Armstrong, F.R.S., and supported by the president, was briefly acknowledged by the lecturer.

THE RELATIONS BETWEEN VARIOUS SOLAR PHENOMENA.

TWO papers recently published in the *Comptes rendus* (No. 10, September 2, and No. 12, September 16), by Prof. Riccò and M. Deslandres respectively, contain several very important statements, concerning the interrelations of such solar phenomena as *filaments, alignements,* prominences, spots, &c., which no student of solar physics can afford to neglect, and which we briefly summarise below.

Prof. Riccò, having studied his valuable records of limb prominences and also those published by Wolfer, finds that the prominences frequently appear in the same position on the sun's limb for several consecutive days, and so must form files of prominence activity across the disc, strongly resembling M. Deslandres's filaments and alignments; he also finds limb prominences recorded at the time and in the positions indicated by M. Deslandres's filaments and alignments. He concludes that there is an indisputable connection between the two sets of phenomena. With sun-spots, however, he finds no connection with the filaments and alignments. But in his paper M. Deslandres considerably modifies this latter conclusion of Prof. Riccò's, and states that there is a general connection, the several phenomena obviously belonging to one system and reacting on each other.

M. Deslandres, in order to make the investigation more precise, gives further important results concerning the filaments and alignments shown on his wonderful series of photographs. He agrees that a prominence on the limb generally means a filament or alignment joining the limb at that point. The relation between the two sets of phenomena is confirmed. Further, he differentiates more clearly between filaments and alignments, the former being a special case of the latter, which cover much greater lengths. Alignments vary in intensity from feebly bright to very dark, and then merge into filaments which are exceptionally black and well defined. The alignments are frequently bordered, diffusely, with parallel bright lines, whereas the filaments are clearly-cut lines. Filaments are found on both the "hydrogen" and the "calcium" photographs, most strongly marked on the former, whereas alignments are, in general, only found on the "calcium" photographs. The brightest prominences occur at the ends of these bright companions of the alignments, and are, therefore, as Prof. Riccò also points out, not symmetrically placed with regard to the central dark alignment. Prof. Riccò suggests that this asymmetry is due to the fact that while the prominences are emission, the alignments are absorption, phenomena, and thus the two things probably represent activity in different layers of the solar atmosphere.

M. Deslandres suggests that the restriction of alignments to the "calcium" photographs, whereas the filaments are better shown on the "hydrogen" plates, may be due to the fact that the filaments probably exist at higher levels, not so readily reached by the calcium vapours. He also suggests that those eruptive prominences not connected with spots are intimately connected with filaments, and in his radial-velocity

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